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## NOTICE OF ALLOWANCE AND FEE(S) DUE

23364 7590 02/24/2009

BACON & THOMAS, PLLC  
625 SLATERS LANE  
FOURTH FLOOR  
ALEXANDRIA, VA 22314-1176

EXAMINER

QUARTERMAN, KEVIN J

ART UNIT

PAPER NUMBER

2889

DATE MAILED: 02/24/2009

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/522,572	01/28/2005	Kun-Hong Lee	LEEK3013/REF	8793

TITLE OF INVENTION: ELECTRIC FIELD EMISSION DEVICE HAVING A TRIODE STRUCTURE FABRICATED BY USING AN ANODIC OXIDATION PROCESS AND METHOD FOR FABRICATING SAME

APPLN. TYPE	SMALL ENTITY	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	YES	\$755	\$300	\$0	\$1055	05/26/2009

THE APPLICATION IDENTIFIED ABOVE HAS BEEN EXAMINED AND IS ALLOWED FOR ISSUANCE AS A PATENT. **PROSECUTION ON THE MERITS IS CLOSED.** THIS NOTICE OF ALLOWANCE IS NOT A GRANT OF PATENT RIGHTS. THIS APPLICATION IS SUBJECT TO WITHDRAWAL FROM ISSUE AT THE INITIATIVE OF THE OFFICE OR UPON PETITION BY THE APPLICANT. SEE 37 CFR 1.313 AND MPEP 1308.

THE ISSUE FEE AND PUBLICATION FEE (IF REQUIRED) MUST BE PAID WITHIN **THREE MONTHS** FROM THE MAILING DATE OF THIS NOTICE OR THIS APPLICATION SHALL BE REGARDED AS ABANDONED. **THIS STATUTORY PERIOD CANNOT BE EXTENDED.** SEE 35 U.S.C. 151. THE ISSUE FEE DUE INDICATED ABOVE DOES NOT REFLECT A CREDIT FOR ANY PREVIOUSLY PAID ISSUE FEE IN THIS APPLICATION. IF AN ISSUE FEE HAS PREVIOUSLY BEEN PAID IN THIS APPLICATION (AS SHOWN ABOVE), THE RETURN OF PART B OF THIS FORM WILL BE CONSIDERED A REQUEST TO REAPPLY THE PREVIOUSLY PAID ISSUE FEE TOWARD THE ISSUE FEE NOW DUE.

## HOW TO REPLY TO THIS NOTICE:

I. Review the SMALL ENTITY status shown above.

If the SMALL ENTITY is shown as YES, verify your current SMALL ENTITY status:

A. If the status is the same, pay the TOTAL FEE(S) DUE shown above.

B. If the status above is to be removed, check box 5b on Part B - Fee(s) Transmittal and pay the PUBLICATION FEE (if required) and twice the amount of the ISSUE FEE shown above, or

If the SMALL ENTITY is shown as NO:

A. Pay TOTAL FEE(S) DUE shown above, or

B. If applicant claimed SMALL ENTITY status before, or is now claiming SMALL ENTITY status, check box 5a on Part B - Fee(s) Transmittal and pay the PUBLICATION FEE (if required) and 1/2 the ISSUE FEE shown above.

II. PART B - FEE(S) TRANSMITTAL, or its equivalent, must be completed and returned to the United States Patent and Trademark Office (USPTO) with your ISSUE FEE and PUBLICATION FEE (if required). If you are charging the fee(s) to your deposit account, section "4b" of Part B - Fee(s) Transmittal should be completed and an extra copy of the form should be submitted. If an equivalent of Part B is filed, a request to reapply a previously paid issue fee must be clearly made, and delays in processing may occur due to the difficulty in recognizing the paper as an equivalent of Part B.

III. All communications regarding this application must give the application number. Please direct all communications prior to issuance to Mail Stop ISSUE FEE unless advised to the contrary.

**IMPORTANT REMINDER:** Utility patents issuing on applications filed on or after Dec. 12, 1980 may require payment of maintenance fees. It is patentee's responsibility to ensure timely payment of maintenance fees when due.

# **PART B - FEE(S) TRANSMITTAL**

**Complete and send this form, together with applicable fee(s), to:** Mail **Mail Stop ISSUE FEE**  
**Commissioner for Patents**  
**P.O. Box 1450**  
**Alexandria, Virginia 22313-1450**  
**or Fax** **(571)-273-2885**

**INSTRUCTIONS:** This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 5 should be completed where appropriate. All further correspondence including the Patent, advance orders and notification of maintenance fees will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications.

CURRENT CORRESPONDENCE ADDRESS (Note: Use Block 1 for any change of address)

Note: A certificate of mailing can only be used for domestic mailings of the Fee(s) Transmittal. This certificate cannot be used for any other accompanying papers. Each additional paper, such as an assignment or formal drawing, must have its own certificate of mailing or transmission.

23364 7590 02/24/2009

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**ALEXANDRIA, VA 22314-1176**

## **Certificate of Mailing or Transmission**

I hereby certify that this Fee(s) Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Mail Stop ISSUE FEE address above, or being facsimile transmitted to the USPTO (571) 273-2885, on the date indicated below.

(Depositor's name)
(Signature)
(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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10/522,572 01/28/2005 Kun-Hong Lee LEEK3013/REF 8793

**TITLE OF INVENTION: ELECTRIC FIELD EMISSION DEVICE HAVING A TRIODE STRUCTURE FABRICATED BY USING AN ANODIC OXIDATION PROCESS AND METHOD FOR FABRICATING SAME**

APPLN. TYPE	SMALL ENTITY	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	YES	\$755	\$300	\$0	\$1055	05/26/2009

EXAMINER	ART UNIT	CLASS-SUBCLASS
QUARTERMAN, KEVIN J	2889	313-495000

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).

- ☐ Change of correspondence address (or Change of Correspondence Address form PTO/SB/122) attached.  
☐ "Fee Address" indication (or "Fee Address" Indication form PTO/SB/47; Rev 03-02 or more recent) attached. Use of a **Customer Number** is required.

2. For printing on the patent front page, list

- (1) the names of up to 3 registered patent attorneys or agents OR, alternatively, 1  
(2) the name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed. 2  
3

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document has been filed for recordation as set forth in 37 CFR 3.11. Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE

(B) RESIDENCE: (CITY AND STATE OR COUNTRY)

Please check the appropriate assignee category or categories (will not be printed on the patent): ☐ Individual ☐ Corporation or other private group entity ☐ Government

4a. The following fee(s) are submitted:

- ☐ Issue Fee  
☐ Publication Fee (No small entity discount permitted)  
☐ Advance Order - # of Copies \_\_\_\_\_

4b. Payment of Fee(s): (Please first reapply any previously paid issue fee shown above)

- ☐ A check is enclosed.  
☐ Payment by credit card. Form PTO-2038 is attached.  
☐ The Director is hereby authorized to charge the required fee(s), any deficiency, or credit any overpayment, to Deposit Account Number \_\_\_\_\_ (enclose an extra copy of this form).

5. **Change in Entity Status** (from status indicated above)

- ☐ a. Applicant claims SMALL ENTITY status. See 37 CFR 1.27. ☐ b. Applicant is no longer claiming SMALL ENTITY status. See 37 CFR 1.27(g)(2).

NOTE: The Issue Fee and Publication Fee (if required) will not be accepted from anyone other than the applicant; a registered attorney or agent; or the assignee or other party in interest as shown by the records of the United States Patent and Trademark Office.

Authorized Signature \_\_\_\_\_ Date \_\_\_\_\_  
Typed or printed name \_\_\_\_\_ Registration No. \_\_\_\_\_

This collection of information is required by 37 CFR 1.311. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, Virginia 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, Virginia 22313-1450.

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10/522,572	01/28/2005	Kun-Hong Lee	LEEK3013/REF	8793
23364	7590	02/24/2009	EXAMINER	
BACON & THOMAS, PLLC 625 SLATERS LANE FOURTH FLOOR ALEXANDRIA, VA 22314-1176			QUARTERMAN, KEVIN J	
			ART UNIT	PAPER NUMBER
			2889	
DATE MAILED: 02/24/2009				

## Determination of Patent Term Adjustment under 35 U.S.C. 154 (b) (application filed on or after May 29, 2000)

The Patent Term Adjustment to date is 561 day(s). If the issue fee is paid on the date that is three months after the mailing date of this notice and the patent issues on the Tuesday before the date that is 28 weeks (six and a half months) after the mailing date of this notice, the Patent Term Adjustment will be 561 day(s).

If a Continued Prosecution Application (CPA) was filed in the above-identified application, the filing date that determines Patent Term Adjustment is the filing date of the most recent CPA.

Applicant will be able to obtain more detailed information by accessing the Patent Application Information Retrieval (PAIR) WEB site (<http://pair.uspto.gov>).

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Customer Service Center of the Office of Patent Publication at 1-(888)-786-0101 or (571)-272-4200.

**Notice of Allowability****Application No.**

10/522,572

**Applicant(s)**

LEE ET AL.

**Examiner**

Kevin Quarterman

**Art Unit**

2889

**-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--**

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to 29 December 2008.
2. ☒ The allowed claim(s) is/are 1-39.
3. ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some\* c) ☐ None of the:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_.
3. ☒ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

\* Certified copies not received: \_\_\_\_.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.

**THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.**

4. ☐ A SUBSTITUTE OATH OR DECLARATION must be submitted. Note the attached EXAMINER'S AMENDMENT or NOTICE OF INFORMAL PATENT APPLICATION (PTO-152) which gives reason(s) why the oath or declaration is deficient.
5. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
- (a) ☐ including changes required by the Notice of Draftsperson's Patent Drawing Review (PTO-948) attached
- 1) ☐ hereto or 2) ☐ to Paper No./Mail Date \_\_\_\_.
- (b) ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date \_\_\_\_.
- Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).
6. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

**Attachment(s)**

1. ☐ Notice of References Cited (PTO-892)
2. ☐ Notice of Draftperson's Patent Drawing Review (PTO-948)
3. ☒ Information Disclosure Statements (PTO/SB/08),  
Paper No./Mail Date 1208
4. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material
5. ☐ Notice of Informal Patent Application
6. ☐ Interview Summary (PTO-413),  
Paper No./Mail Date \_\_\_\_.
7. ☐ Examiner's Amendment/Comment
8. ☒ Examiner's Statement of Reasons for Allowance
9. ☐ Other \_\_\_\_.

## **DETAILED ACTION**

### ***Response to Amendment***

1. Applicant's remarks received 29 December 2008 have been entered and overcome the provisional double patenting rejection of the claims recited in the previous office action.

### ***Allowable Subject Matter***

2. Claims 1-39 are allowed.
3. The following is an examiner's statement of reasons for allowance: Regarding independent claim 1, the prior art of record neither shows or suggests an electric field emission device having a triode structure comprising, in a addition to other limitations of the claim, an alumina layer formed on a gate electrode layer, the alumina layer having a plurality of third sub-micro holes each connecting to a corresponding one of second sub-micro holes formed in the gate electrode layer, wherein the alumina layer and the plurality of third sub-micro holes are formed by an anodic oxidation process.
4. The closest prior art of Cho (KR 10-2002-0041665) to independent claim 1 teaches an electric field emission device having a triode structure fabricated using an anodic oxidation process comprising a supporting substrate (10); a bottom electrode layer (11) formed on the supporting substrate, which is used as a cathode electrode of the device; a gate insulating layer (12) formed on the bottom electrode layer, the gate insulating layer having a plurality of first sub-micro holes (25) to be used as gate holes of the device; a gate electrode layer (13) formed on the gate insulating layer, the gate electrode layer having a plurality of second sub-micro holes each connecting to a

corresponding one of the first sub-micro holes; a top electrode layer (Fig. 8) for hermetically sealing the device in a vacuum, which is used as an anode of the device; and a plurality of emitters (23) for emitting electrons in a high electric field, each of the emitters being formed in a corresponding one of the first sub-micro holes.

5. However, Cho fails to exemplify an alumina layer formed on a gate electrode layer, the alumina layer having a plurality of third sub-micro holes each connecting to a corresponding one of second sub-micro holes formed in the gate electrode layer, wherein the alumina layer and the plurality of third sub-micro holes are formed by an anodic oxidation process, as recited in independent claim 1. Due to their dependencies upon independent claim 1, claims 2-5 are also allowable.

6. Regarding independent claim 6, the prior art of record neither shows or suggests an electric field emission device having a triode structure comprising, in addition to other limitations of the claim, an anode insulating layer formed on a gate electrode layer, the anode insulating layer having a plurality of third sub-micro holes each connecting to a corresponding one of second sub-micro holes formed in the gate electrode layer.

7. The closest prior art of Cho (KR 10-2002-0041665) to independent claim 6 teaches an electric field emission device having a triode structure fabricated using an anodic oxidation process comprising a supporting substrate (10); a bottom electrode layer (11) formed on the supporting substrate, which is used as a cathode electrode of the device; a gate insulating layer (12) formed on the bottom electrode layer, the gate insulating layer having a plurality of first sub-micro holes (25) to be used as gate holes of the device; a gate electrode layer (13) formed on the gate insulating layer, the gate

electrode layer having a plurality of second sub-micro holes each connecting to a corresponding one of the first sub-micro holes; a top electrode layer (Fig. 8) for hermetically sealing the device in a vacuum, which is used as an anode of the device; and a plurality of emitters (23) for emitting electrons in a high electric field, each of the emitters being formed in a corresponding one of the first sub-micro holes.

8. However, Cho fails to exemplify an anode insulating layer formed on a gate electrode layer, the anode insulating layer having a plurality of third sub-micro holes each connecting to a corresponding one of second sub-micro holes formed in the gate electrode layer, as recited in independent claim 6. Due to their dependencies upon independent claim 6, claims 7-10 are also allowable.

9. Regarding independent claim 11, the prior art of record neither shows or suggests a method for fabricating an electric field emission device having a triode structure comprising, in addition to other limitations of the claim, steps of forming a plurality of sub-micro holes in an alumina layer by performing an anodic oxidation process on an aluminum layer, thereby transforming the aluminum layer into the alumina layer.

10. The closest prior art of Cho (KR 10-2002-0041665) to independent claim 11 teaches a method for fabricating an electric field emission device having a triode structure by using an anodic oxidation process comprising the steps of forming a bottom electrode (11) on a supporting substrate (10), the bottom electrode layer being used as a cathode electrode of the device; forming sequentially a gate insulating layer (12) and a gate electrode layer (13), and etching the gate electrode layer, thereby a surface of

the gate insulating layer being exposed through first sub-micro holes; forming a plurality of second sub-micro holes in the gate insulating layer, thereby each of the first sub-micro holes connecting to a corresponding one of the second sub-micro holes; forming an emitter (23) for emitting electrons in a high electric field in each of the second sub-micro holes; and forming a top electrode layer (Fig. 8) for hermetically sealing the device in a vacuum, the top electrode layer being used as an anode of the device.

11. However, Cho fails to exemplify a step of forming a plurality of sub-micro holes in an alumina layer by performing an anodic oxidation process on an aluminum layer, thereby transforming the aluminum layer into the alumina layer, as recited in independent claim 11. Due to their dependencies upon independent claim 11, claims 12-25 are also allowable.

12. Regarding independent claim 26, the prior art of record neither shows or suggests a method for fabricating an electric field emission device having a triode structure comprising, in addition to other limitations of the claim, steps of forming a plurality of sub-micro holes in an alumina layer by performing an anodic oxidation process on an aluminum layer, thereby transforming the aluminum layer into the alumina layer.

13. The closest prior art of Cho (KR 10-2002-0041665) to independent claim 26 teaches a method for fabricating an electric field emission device having a triode structure by using an anodic oxidation process comprising the steps of forming a bottom electrode (11) on a supporting substrate (10), the bottom electrode layer being used as a cathode electrode of the device; forming sequentially a gate insulating layer (12) and



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a gate electrode layer (13); etching the gate electrode layer, thereby a surface of the gate insulating layer being exposed through first sub-micro holes; forming a plurality of second sub-micro holes in the gate insulating layer, thereby each of the first sub-micro holes connecting to a corresponding one of the second sub-micro holes; forming an emitter (23) for emitting electrons in a high electric field in each of the second sub-micro holes; and forming a top electrode layer (Fig. 8) for hermetically sealing the device on the alumina layer in a vacuum, the top electrode layer being used as an anode of the device.

14. However, Cho fails to exemplify a step of forming a plurality of sub-micro holes in an alumina layer by performing an anodic oxidation process on an aluminum layer, thereby transforming the aluminum layer into the alumina layer. Due to their dependencies upon independent claim 26, claims 27-39 are also allowable.

15. The subject alumina layer structures described earlier are provided for decreasing a driving voltage for the electric field emission device. The design is new and unique to the art.

16. Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

***Contact Information***

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Kevin Quarterman whose telephone number is (571)272-2461. The examiner can normally be reached on M-TH (7-5:30).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Minh-Toan Ton can be reached on (571) 272-2303. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Kevin Quarterman  
Examiner  
Art Unit 2889

/K. Q./  
Examiner, Art Unit 2889  
24 February 2009

/Joseph L. Williams/  
Primary Examiner, Art Unit 2889